# Stanford Machine Learning Week 2. Linear Regression with multiple variables.

- multiple inputs (information) to predict.
- input: $x_1, x_2, \dots x_n$. ; output: $y$.

e.g.

| $x_1$ size | $x_2$. # of bedrooms | $x_3$ Number of Floors | $x_4$ Age of home | price ($y$) |
|---|---|---|---|---|
| | | | | |

} m samples

Notation:

$n$ - number of features.

$x^{(i)}$ - input (features) of $i^{th}$ training sample $\rightarrow$ $x^{(i)} = \begin{pmatrix} x^{(i)}_1 \\ x^{(i)}_2 \\ \vdots \\ x^{(i)}_n \end{pmatrix}$

index to training set

$x_j^{(i)}$ - value of feature $j$ in $i^{th}$ training sample

$\Rightarrow$ $x^{(i)} = [x_j^{(i)}]$.

# n-dimensional vector.

- Hypothesis

previously $h_\theta(x) = \theta_0 + \theta_1 x$

now $\rightarrow$ $h_\theta(x) = \theta_0 + \theta_1 x_1 + \cdots + \theta_n x_n$

define: $x_0 = 1$, i.e. $x_0^{(i)} = 1 \quad \forall i$

$$\Rightarrow \quad x = \begin{bmatrix} x_0 \\ \vdots \\ x_n \end{bmatrix} \in \mathbb{R}^{n+1} \quad ; \quad \theta = \begin{bmatrix} \theta_0 \\ \vdots \\ \theta_n \end{bmatrix} \in \mathbb{R}^n.$$

$h_\theta(x) = \theta_0 x_0 + \cdots + \theta_n x_n$

$= \theta^T \cdot x$ ( expressed as inner product of vectors )

$\Rightarrow$ Multivariate Linear Regression: $h_\theta(x) = \theta^T \cdot x$.